REMARKS/ARGUMENTS

In response to the Office Action dated June 4, 2003, claims 1, 2, 6, 7, 8, 22, 23, 25-28, and 30 are amended. Claims 3-5 and 9-21 were previously canceled without prejudice or waiver. Claims 31-35 are added in this amendment. Claims 1, 2, 6-8, and 22-35 remain in the application. It is not the Applicants' intent to surrender any equivalents because of the amendments or arguments made herein. Reexamination and reconsideration of the application are respectfully requested.

Objections to The Abstract

In paragraph 3 of the Office Action, the abstract was objected to since it should be in the range of 50 to 150 words.

Applicants respectfully traverse the objection. The Applicants note that the only requirement under 35 U.S.C. 111 is that the Abstract may not exceed 150 words in length. Applicants respectfully submit that the Abstract conforms with all requirements of MPEP 608.01(b) since the Abstract is less than 150 words. Accordingly, the Abstract has not been amended, and the Applicants respectfully request that the objection be withdrawn.

Art-Based Rejections

In paragraphs 4-5 of the Office Action, claims 1-2, 6-8, and 22-25 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Carlson et al. (USP 5,421,957) in view of Laxman et al. (USP 5,874,368), and claims 26-30 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Carlson and Laxman, as applied to claims 1 and 6, and further in view of Nagashima et al. (USP 5,129,958).

Applicants respectfully traverse these rejections for at least the following reasons. The Applicants respectfully submit that the claims are patentable in light of the clarifying amendments above and the arguments below.

The Carlson Reference

The Carlson reference, cited by the Applicants, discloses low temperature etching in cold-wall CVD systems. The Carlson method disclosedis a method of etching or cleaning a cold-wall chemical vapor deposition chamber that is substantially moisture-free at a low chamber temperature and a low chamber pressure while maintaining a satisfactory etch rate by using at least one etchant gas selected from the group consisting of nitrogen trifluoride, chlorine trifluoride, sulfur hexafluoride, carbon tetrafluoride, or the like and mixtures thereof. See Abstract.

The Laxman Reference

The Laxman reference is cited for disclosing a process for the low pressure chemical vapor deposition of silicon mitride from ammonia and bis tertiary butyl amino silane. See Abstract.

The Nagashima Reference

The Nagashima reference is cited for disclosing purging the reaction container with ammonia gas. See Col. 2, lines 45-50.

The Claims are Patentable Over the Cited References

The claims of the present invention are directed to semiconductor device manufacturing methods. A method in accordance with the present invention comprises forming, by a thermal chemical vapor deposition method, a silicon nitride film on an object disposed in a reaction container, with bis tertiary butyl amino silane and NH_3 flowing into said reaction container, and

removing silicon nitride formed in said reaction container, with NF_3 gas flowing into said reaction container, before said silicon nitride formed in said reaction container reaches a thickness of 4,000 Å.

The cited references do not teach nor suggest the limitations of the present invention. Specifically, the cited references do not teach nor suggest, with respect to independent claims 1, 22, and 31, the limitation of removing the silicon nitride formed in the reaction container before said silicon nitride formed in said reaction container reaches a thickness of 4,000 Å as disclosed in the claims of the present invention, and, with respect to independent claim 27, the cited references do not teach nor suggest the limitation of purging said reaction container using said NH_3 gas after carrying said object into said reaction container and at least one of before and after forming said silicon nitride film as recited in claim 27 of the present invention.

Independent claims 1, 22, and 31, and Claims Dependent Thereon

The Carlson reference merely discusses films of one to five micrometers thickness contaminating the process. Carlson ignores films of less than one micrometer, which is a thickness of 10,000 angstroms.

Carlson, if applied to silicon nitride formation using Bis Tertiary Butyl Amino Silane (BTBAS) and ammonia, would not consider a thickness of 4000 angstroms as a film that requires cleaning or having contamination. However,

films of 4000 angstrom thickness formed using BTBAS and ammonia would contain microcracks, because silicon nitride formed using such a method contains different characteristics than silicon nitride formed using SiH_4 and ammonia or SiH_2C_{12} and ammonia.

Since the primary Carlson reference is silent on silicon nitride films of less than 10,000 angstroms, it cannot disclose the limitation of removing the silicon nitride formed in the reaction container before it reaches a thickness of 4000 angstroms as recited in claims 1, 22, and 31 of the present invention.

The ancillary Laxman reference does not remedy the deficiencies of the primary Carlson reference. Namely, Laxman does not teach nor suggest the limitation of removing the silicon nitride formed in the reaction container before it reaches a thickness of 4000 angstroms as recited in claims 1, 22, and 31 of the present invention.

Thus, it is respectfully submitted that independent claims 1, 22, and 31 are patentable over the cited references. Claims 2, 6-8, 23-26, and 32-35 are also patentable over the cited references, not only because they contain all of the limitations of the independent claims, but because claims 2, 6-8, 23-26, and 32-35 also describe additional novel elements and features that are not described in the prior art.

Independent Claim 27, and Claims Dependent Thereon

The Office Action relies on Nagashima to show the ammonia purge step of claim 27.

The ancillary Nagashima reference discusses removing fluorine residues generated by fluorine plasma cleaning by introducing a reducing gas, such as ammonia, into the CVD chamber after the plasma cleaning to purge the CVD chamber. Such plasma cleaning and reducing gasses purge steps are performed on

the CVD chamber when wafers and other objects that are to be film-formed are not present.

However, claim 27 of the present invention recites that the purging of the reaction container using said NH_3 gas is done after carrying said object into said reaction container. As such, Nagashima does not disclose this limitation of the claim.

The Applicants respectfully submit that the Carlson and Laxman references do not remedy the deficiency of the relied-upon Nagashima reference, namely, that neither Carlson nor Laxman teach nor suggest the limitation of purging of the reaction container using said NH_3 gas after carrying said object into said reaction container as recited in claim 27 of the present invention.

Thus, it is submitted that independent claim 27 is patentable over the cited references. Claims 28-30 are also patentable over the cited references, not only because they contain all of the limitations of independent claim 27, but because claims 28-30 also describe additional novel elements and features that are not described in the prior art.

Conclusion

In view of the foregoing, it is respectfully submitted that the application is in condition for allowance. Reexamination and reconsideration of the application, as amended, are requested.

If for any reason the Examiner finds the application other than in condition for allowance, the Examiner is requested to call the undersigned attorney at the Los Angeles, California telephone number (213) 337-6742 to discuss the steps necessary for placing the application in condition for allowance.

If there are any fees due in connection with the filing of this response, please charge the fees to our Deposit Account No. 50-1314.

Respectfully submitted,
HOGAN & HARTSON L.L.P.

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By: _____
Anthony J. Orler
Registration No. 41,232
Attorney for Applicant(s)

500 South Grand Avenue, Suite 1900
Los Angeles, California 90071
Phone: 213-337-6700
Fax: 213-337-6701